Scientific Excellence • Resource Protection & Conservation • Benefits for Canadians
Excellence scientifique • Protection et conservation des ressources • Bénéfices aux Canadiens

Hook and Line Survey of Lingcod *(Ophiodon elongatus)* Stocks in the Gulf Islands Region (MSA 17) of the Strait of Georgia, 1985 to 1988

C. M. Hand and L. J. Richards

Department of Fisheries and Oceans
Biological Sciences Branch
Pacific Biological Station
Nanaimo, British Columbia V9R 5K6

December 1989

Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 2043

Fisheries and Oceans Pêches et Océans

Canada

Canadian Manuscript Report of Fisheries and Aquatic Sciences

Manuscript reports contain scientific and technical information that contributes to existing knowledge but which deals with national or regional problems. Distribution is restricted to institutions or individuals located in particular regions of Canada. However, no restriction is placed on subject matter, and the series reflects the broad interests and policies of the Department of Fisheries and Oceans, namely, fisheries and aquatic sciences.

Manuscript reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report is abstracted in *Aquatic Sciences and Fisheries Abstracts* and indexed in the Department's annual index to scientific and technical publications.

Numbers 1–900 in this series were issued as Manuscript Reports (Biological Series) of the Biological Board of Canada, and subsequent to 1937 when the name of the Board was changed by Act of Parliament, as Manuscript Reports (Biological Series) of the Fisheries Research Board of Canada. Numbers 901–1425 were issued as Manuscript Reports of the Fisheries Research Board of Canada. Numbers 1426–1550 were issued as Department of Fisheries and the Environment, Fisheries and Marine Service Manuscript Reports. The current series name was changed with report number 1551.

Manuscript reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page. Out-of-stock reports will be supplied for a fee by commercial agents.

Rapport manuscrit canadien des sciences halieutiques et aquatiques

Les rapports manuscrits contiennent des renseignements scientifiques et techniques qui constituent une contribution aux connaissances actuelles, mais qui traitent de problèmes nationaux ou régionaux. La distribution en est limitée aux organismes et aux personnes de régions particulières du Canada. Il n'y a aucune restriction quant au sujet; de fait, la série reflète la vaste gamme des intérêts et des politiques du ministère des Pêches et des Océans, c'est-à-dire les sciences halieutiques et aquatiques.

Les rapports manuscrits peuvent être cités comme des publications complètes. Le titre exact paraît au-dessus du résumé de chaque rapport. Les rapports manuscrits sont résumés dans la revue *Résumés des sciences aquatiques et halieutiques*, et ils sont classés dans l'index annuel des publications scientifiques et techniques du Ministère.

Les numéros 1 à 900 de cette série ont été publiés à titre de manuscrits (série biologique) de l'Office de biologie du Canada, et après le changement de la désignation de cet organisme par décret du Parlement, en 1937, ont été classés comme manuscrits (série biologique) de l'Office des recherches sur les pêcheries du Canada. Les numéros 901 à 1425 ont été publiés à titre de rapports manuscrits de l'Office des recherches sur les pêcheries du Canada. Les numéros 1426 à 1550 sont parus à titre de rapports manuscrits du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 1551.

Les rapports manuscrits sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre. Les rapports épuisés seront fournis contre rétribution par des agents commerciaux.

Canadian Manuscript Report of
Fisheries and Aquatic Sciences No. 2043

December 1989

HOOK AND LINE SURVEY OF LINGCOD (*Ophiodon elongatus*) STOCKS IN THE GULF ISLANDS REGION (MSA 17) OF THE STRAIT OF GEORGIA, 1985 TO 1988

by

C. M. Hand and L. J. Richards

Department of Fisheries and Oceans
Biological Sciences Branch
Pacific Biological Station
Nanaimo, British Columbia V9R 5K6

90-03436/

(c) Minister of Supply and Services Canada 1989

Cat. No. Fs 97-4/2043E ISSN 0706-6473

Correct citation for this publication:

Hand, C. M. and L. J. Richards. 1989. Hook and line survey of lingcod (Ophiodon elongatus) stocks in the Gulf Islands region (MSA 17) of the Strait of Georgia, 1985 to 1988. Can. MS Rep. Fish. Aquat. Sci. 2043: 45 p.

ABSTRACT

Hand, C. M. and L. J. Richards. 1989. Hook and line survey of lingcod (Ophiodon elongatus) stocks in the Gulf Islands region (MSA 17) of the Strait of Georgia, 1985 to 1988. Can. MS Rep. Fish. Aquat. Sci. 2043: 45 p.

A survey of lingcod stocks in the Gulf Islands region of the Strait of Georgia was conducted, in three parts, from 1985 to 1988. The purpose of the survey was to compare trends in catch-per-unit-effort (CPUE) obtained from sales slip data to trends in CPUE obtained under known experimental conditions, and thus to evaluate the representativeness of the sales slip CPUE. This report documents part three of the survey and discusses the results in relation to parts one and two. There was a significant decrease in lingcod CPUE over the three years of the survey. Survey CPUE was remarkably similar to sales slip CPUE in both its trend and absolute value. Sales slip CPUE therefore appears to be representative of stock trends. The survey results corroborate previous evidence that lingcod stocks in the Strait of Georgia have declined.

RÉSUMÉ

Hand, C. M. et L. J. Richards. 1989. Hook and line survey of lingcod (Ophiodon elongatus) stocks in the Gulf Islands region (MSA 17) of the Strait of Georgia, 1985 to 1988. Can. MS Rep. Fish. Aquat. Sci. 2043: 45 p.

Un relevé en trois étapes des stocks de morue-lingue a été effectué dans la région des îles du golfe du détroit de Géorgie entre 1985 et 1988. Le relevé avait pour but de comparer les tendances des prises par unité d'effort (PPUE) tirées des données fournies par les reçus de caisse, aux tendances des PPUE obtenues dans des conditions, expérimentales connues, afin de juger si les reçus de caisse représentent réellement les PPUE. Le présent rapport renferme les données de la troisième étape du relevé; les résultats sont comparés au bilan des deux premières étapes. Il y a eu une baisse marquée des PPUE de morue-lingue au cours des trois années du relevé. Les PPUE constatées au cours de relevé sont remarquablement semblables aux données tirées des reçus de caisse, tant pour les tendances que pour la valeur absolue. Il semble donc que les données sur les PPUE tirées des reçus de caisse reflètent les tendances des stocks. Les résultats du relevé confirment ce qui avait été constaté antérieurement, c'est-à-dire que les stocks de morue-lingue ont diminué dans le détroit de Géorgie.

INTRODUCTION

The Strait of Georgia has supported a hook and line fishery for lingcod since the early 1900s. The stocks were heavily exploited in the late 1920s and in the 1930s, with annual catches of over 2000 t and a peak landing of 3000 t in 1936 (Ketchen et al. 1983). Landings remained high through the 1940s and 1950s, but have declined steadily since the early 1960s to a level of 83 t in 1988. The reason for this decline is unknown but it is believed to reflect a decline in stock abundance due to overfishing (Richards and Hand in prep.).

The only source of catch and effort data for this hook and line fishery is sales slip records collected by the Department of Fisheries and Oceans, Fisheries Branch. These data have been stored on computer tape since 1967 and include landed weight, days fished, and area fished. The catch per unit effort (CPUE) determined from these data has been used to assess lingcod stocks in the past (Cass 1985), but the representativeness of these data as an index of abundance is unknown.

To test the reliability of the sales records, a study was undertaken in 1985 to compare the CPUE determined from the catch and effort data to CPUE determined under known, experimental conditions. In this report, we present the results from the third and final part of a hook and line survey of Statistical Area 17, conducted from December 1987 to February 1988, and discuss the findings in relation to parts 1 and 2. Results of parts 1 and 2, conducted during October to December 1985 and January to February 1987, respectively, are presented in Cass and Richards (1987) and Hand and Richards (1987).

METHODS

The survey design was identical to that used in the previous surveys (Cass and Richards 1987, Hand and Richards 1987). Fishing was again conducted from the F/V BLACK HEART, with two commercial fishermen using commercial gear and live bait, and two research personnel using a standardized hook-and-line method developed in previous surveys (Richards et al. 1985; Richards and Cass 1985). Commercial gear consisted of 23-kg-test monofilament handline with a steel leader and 0.5-kg lead weight. Double Mustad #93664 size-6 hooks with 10-cm spacing were hooked through the snout and dorsal muscle of 15-cm to 20-cm live herring. Research gear consisted of rod and reel with 9-kg-test monofilament and a 7-kg test leader with mooching weights of 170 g. Double Mustad #92553 size 3/0 hooks with 6-cm spacing were

hooked through the snout and near the dorsal fin of frozen 12-cm bait herring.

Fishing sites were within the same 1-min-latitude-by-1-min-longitude blocks defined in the previous surveys. Fishing within each site was stratified by depth into three intervals: 4-15 fath (10-26 m), 16-25 fath (27-46 m) and 26-35 fath (47-55 m). Fishing positions within a site-depth stratum were changed according to the following:

1. If no fish were caught in a 10 min. period.
2. If the catch was predominantly dogfish.
3. If more than 10 fish of one species were caught.

Each set (site-depth-time stratum) was fished for a minimum of 15 min per angler, unless one of the above conditions prevailed. Each site-depth stratum was fished on at least two different days. Fishing time was measured separately for each angler with a stop watch and represented the time elapsed while the bait was in position near the bottom. The watch was stopped when a fish was hooked, the line became fouled on the bottom or the line was hauled in. Fishing effort for the set was defined as the sum of the times for each angler, recorded separately for research and commercial gears.

A catch was recorded if the fish was landed or brought to a depth at which it could be visually identified. Landed rockfish and lingcod were measured for fork length to the nearest mm, weighed to the nearest 0.1 kg and examined for sex and maturity. Otoliths were collected from rockfish and the 4th-9th rays of the second dorsal fin were collected from lingcod for age determination.

Weather and sea conditions were also recorded for each set.

RESULTS AND DISCUSSION

CRUISE SUMMARY

The ten sites that were fished in 1985 and 1987 were resurveyed in January and February 1988 (Fig. 1). Each site was fished on at least two separate days. Catch and effort data for each species at each time-depth-site stratum are presented in Appendix Table 1. Appendix Table 2 lists the codes used to identify cloud cover, sea condition, tide, current, depth and

gear type. The biological data on individual fish are presented in Appendix Table 3 and Appendix Table 4 lists the codes used to classify maturity stages in lingcod and rockfish.

CATCH RATES

CPUE at each site-depth stratum for commercial gear and research gear is shown in Table 1. The commercial CPUE for all species combined ranged from 0 to 14.2 fish h^{-1} with a mean and one standard error of 4.5 ± 0.68 fish h^{-1}, while total research CPUE ranged from 0 to 13.2 fish h^{-1} (mean 5.0 ± 0.65 fish h^{-1}). Commercial lingcod CPUE ranged from 0 to 14.2 fish hr^{-1} (mean 3.0 ± 0.65 fish h^{-1}) and research rockfish CPUE ranged from 0 to 11.5 fish h^{-1} (mean 4.1 ± 0.59 fish h^{-1}).

Variation in CPUE may be due to a number of factors. The effects of cloud cover, sea condition, tide, current, time of day and fishing method on CPUE were tested separately for each depth interval. Except for fishing method and depth, all factors had an insignificant effect on CPUE (Kruskal-Wallis test; $p>0.05$).

Fishing depth had a significant effect on CPUE for lingcod and copper rockfish (Kruskal-Wallis test; $p<0.001$) such that the CPUE decreased with increasing depth. Quillback rockfish CPUE was unaffected by depth (Fig. 2).

The effect of fishing gear on CPUE was significant for lingcod, quillback rockfish and copper rockfish (Fig. 2). Lingcod CPUE was higher at 96% of the comparable sites and depths using commercial gear (sign test; $n=25$, $p<0.001$). Quillback rockfish CPUE was higher at all comparable sites and depths using research gear (sign test; $n=24$, $p<0.001$) as was copper rockfish CPUE ($n=12$, $p<0.001$).

SPECIES COMPOSITION

Lingcod was the most abundant species caught (38% of the total), followed by quillback rockfish (30%), copper rockfish (15%), spiny dogfish (Squalus acanthias) (10%) and yelloweye rockfish (2%). The combined catches of greenstripe rockfish (Sebastes elongatus), tiger rockfish (S. nigrocinctus), kelp greenling (Hexagrammos decagrammus), red Irish lord (Hemilepidotus hemilepidotus), cabezon (Scorpaenichthys marmoratus), rock sole (Lepidopsetta bilineata), speckled sanddab (Citharichthys stigmaeus) and English sole (Parophrys vetulus)

accounted for 5% of the total. The species composition by depth and site is shown in Table 2.

We tested for the effect of gear type and depth on the proportion of lingcod and quillback and copper rockfish in the catch (Table 3). Gear type had a significant effect on species composition at all depths (chi-square; $p<0.001$). The commercial-gear catch was predominantly lingcod while the research-gear catch was predominantly quillback and copper rockfish (Fig. 3). The species composition was also significantly affected by depth (chi-square, $p<0.025$). The proportion of lingcod in the commercial-gear catch decreased and the proportion of copper and quillback rockfish increased with depth. Quillback and copper rockfish were equally represented in the research-gear catch at shallow depths but the proportion of quillback rockfish increased and the proportion of copper rockfish decreased with depth (Fig. 3).

SIZE COMPOSITION

Mean length and weight for lingcod, quillback rockfish, copper rockfish, and yelloweye rockfish are summarized in Table 4 by sex and gear type. There was no significant difference in median length between male and female rockfish caught with research gear. However, from commercial gear data, female lingcod were significantly larger than male lingcod (Kruskal-Wallis test; $p<0.001$).

Length-frequency histograms for lingcod, copper rockfish and quillback rockfish are shown in Figure 4. Gear type had a significant effect on median size of male lingcod and female quillback rockfish in that commercial gear caught larger fish than research gear (Kruskal-Wallis test; $p<0.05$). The size of copper rockfish was unaffected by gear type. There was a significant difference in median length and weight among depths for male quillback rockfish such that size increased with increasing depth (Kruskal-Wallis test; $p<0.05$); median size of female quillback rockfish and other species was not affected by depth.

Weight-length relationships for lingcod, quillback rockfish and copper rockfish are shown in Figure 5. Parameters for the weight-length regression are presented in Table 5.

MATURITY

Of the 41 male lingcod caught, 95% were mature and of these, 31% were developing, 33% were ripe and 36% were spent (Table 6). The largest immature male was 62 cm and the smallest mature male was 48 cm. Of the 113 female lingcod caught, 77% were mature, of which 28% were developing, 24% were ripe, 43% were spent and 6% were resorbing. The largest immature female was 86 cm and the smallest mature female was 56 cm.

Of the 132 quillback rockfish caught, 92% of the females (n=78) and 80% of the males (n=54) were mature. Of the mature females, 21% contained maturing ova, 75% contained mature ova and 4% contained fertilized ova. Of the mature males, 7% contained developed testes and 93% were in the resting stage (Table 6).

Of the 63 copper rockfish caught, 97% of the females (n=37) and 96% of the males (n=26) were mature. Of the mature females, 22% contained maturing ova, 64% contained mature ova, 11% contained fertilized ova and 3% were resorbing. Of the mature males, 8% contained developed testes and 92% were in the resting stage.

COMPARISON OF 1985, 1987 and 1988 SURVEY RESULTS

Lingcod exhibit seasonal changes in distribution and behaviour with the onset of spawning. Males move into shallow water in December and establish nesting territories. Egg laying proceeds through January and nests are guarded by the male until early April. Females appear to leave the immediate area after spawning (Low and Beamish 1978). A winter closure to protect spawning lingcod is in effect from November 15 to April 30. To avoid conflicts with the commercial fishery, parts two and three of the survey were conducted in January and February. Weather conditions and administrative delays did not permit replication of the survey in November and December as in 1985.

Lingcod CPUE was significantly lower in 1987 and 1988 than in 1985 (Kruskal-Wallis test, $p<0.03$, Table 7). There was, however, no significant difference in CPUE between 1987 and 1988. Lingcod CPUE, as determined from the sales slip data base (Richards and Hand in prep.), also declined during the period of the survey. When the survey CPUE was expressed in kg/dy and compared to the sales slip CPUE, they were found to be remarkably similar, particularly for 1987 and 1988. The CPUE from both sources declined between 1985 and 1987 and then remained unchanged between 1987 and 1988.

The decrease in CPUE between 1985 and 1987 was more dramatic in the survey data than in the sales slip data. An obvious explanation for this is the difference in the timing of the surveys among years. The behaviour of lingcod during their spawning period could very likely affect their catchability. The proportion of the total catch comprised of lingcod decreased from 70% in 1985 to 45% in 1987 and again to 38% in 1988. Of the lingcod caught, there were proportionately fewer males in the Jan/Feb surveys (1987 and 1988) than in the 1985 Oct-Dec survey (Table 7). Male CPUE was lower than female CPUE in all years. However, CPUE for both sexes declined at the same rate. The decrease in both male and female lingcod CPUE between the first survey and the second and third surveys suggests a lower availability of lingcod in general in Jan/Feb than in pre-spawning periods.

The similarity in CPUE between the two sources of data indicates that the sales slip data base is a reliable index of stock abundance. The results of this survey corroborate previous evidence that stocks in the Strait of Georgia have declined, and further suggest that they have been reduced to a level which is unable to support a directed fishery. Landings from the commercial fishery in that area declined from 30 t in 1985 to 7 t in 1988, with increasing amounts of the catch being taken incidentally to other fisheries (Richards and Hand in prep.).

In the absence of a substantial directed lingcod fishery in the Strait of Georgia, valuable biological information was also obtained through this survey. For example, lingcod size-at-maturity information was employed to recommend more biologically meaningful size limits for the commercial and recreational fisheries (Richards and Hand in prep.). There was no significant change in the length and weight of male lingcod between 1985 and 1988. The size of female lingcod was, however, significantly larger in 1988 than in previous years ($p<0.01$, Kruskal Wallis). The percent maturity for male lingcod was similar between surveys, averaging 96%, whereas the percentage of female lingcod that were mature decreased from 60% in 1985 to 35% in 1987 and increased again to 77% in 1988.

ACKNOWLEDGEMENTS

We thank Mr. A. Cass and Mr. J. Candy for their participation in this study. We also thank the two commercial fishermen, Mr. T. Barnes and Mr. A. Crocker, for their advice and expertise during this survey.

REFERENCES

Cass, A. J. 1985. Lingcod stock assessment. In: A. V. Tyler and G. A. McFarlane [eds.]. Groundfish stock assessments for the west coast of Canada in 1984, and recommended yield options for 1985. Can. MS Rep. Fish. Aquat. Sci. 1813: 353 p.

Cass, A. J., R. J. Beamish, and M. S. Smith. 1984. Study of the biology of lingcod off the west coast of Vancouver Island, M/V ARCTIC HARVESTER, November 22-December 2, 1977. Can. Data Rep. Fish. Aquat. Sci. 461: 73 p.

Cass, A. J. and L. J. Richards. 1987. Lingcod hook and line survey in the Gulf Island region (Statistical area 17) of the Strait of Georgia, October-December 1985. Can. MS Rep. Fish. Aquat. Sci. 1934: 65 p.

Hand, C. M. and L. J. Richards. 1987. Hook and line survey of lingcod (Ophiodon elongatus) and rockfish (Sebastes spp.) stocks in the Gulf Islands region (MSA 17) of the Strait of Georgia, January and February, 1987. Can. MS Rep. Fish. Aquat. Sci. 1957: 57 p.

Hand, C. M. and L. J. Richards. 1988. Results of the 1986 rockfish harvest log program. Can. MS Rep. Fish. Aquat. Sci. 1986: 23 p.

Ketchen, K. S., N. Bourne, and T. H. Butler. 1983. History and present status of fisheries for marine fishes and invertebrates in the Strait of Georgia, British Columbia. Can. J. Fish. Aquat. Sci. 40: 1095-1119.

Low, C. J., and R. J. Beamish. 1978. A study of the nesting behavior of lingcod (Ophiodon elongatus) in the Strait of Georgia, British Columbia. Fish. Mar. Serv. Tech. Rep. 843: 27 p.

Richards, L. J. and A. J. Cass. 1985. 1985 research catch and effort data on nearshore reef-fishes in the Strait of Georgia, B.C. (Statistical Areas 15 and 16). Can. MS Rep. Fish. Aquat. Sci. 1851: 68 p.

Richards, L. J., A. J. Cass, J. R. Selsby, R. van den Broek, and S. D. Loynachan. 1985. A summary of research catch and effort data for nearshore reef-fishes collected during 1984 in MSA 15 and 16 of the Strait of Georgia. Can. MS Rep. Fish. Aquat. Sci. 1833: 69 p.

Richards, L. J. and C. M. Hand. (In prep.) Lingcod stock assessment. In: A. V. Tyler and J. Fargo [eds.]. Groundfish stock assessment for the west coast of Canada in 1989 and recommended yield options for 1990. Can. MS Rep. Fish. Aquat. Sci.

Table 1. CPUE (fish h^{-1}) by species and major species groups, for each gear type, site and depth interval during the survey. Depth intervals: (1) 5-27 m, (2) 28-45 m and (3) 46-55 m. Species: LC lingcod, RF all rockfish species, QB quillback rockfish, CO copper rockfish.

Site	Depth interval	Effort (h)	CPUE				
			Total	LC	RF	QB	CO
COMMERCIAL GEAR							
3	1	1.50	12.67	10.67	-	-	-
3	2	1.00	11.00	2.00	-	-	-
3	3	0.58	6.86	1.71	1.71	-	-
7	1	2.33	14.18	14.18	-	-	-
7	2	1.13	3.53	0.88	-	-	-
7	3	1.02	3.93	3.93	-	-	-
12	1	2.03	3.93	3.93	-	-	-
12	2	0.50	-	-	-	-	-
12	3	1.75	5.14	1.70	10.57	-	-
13	1	1.48	10.79	10.11	0.67	0.67	-
13	2	1.43	1.40	0.70	-	-	-
13	3	1.47	3.41	-	-	-	-
15	1	2.05	4.88	3.41	0.49	-	-
15	2	1.37	7.32	6.59	-	-	-
15	3	0.50	4.00	-	4.00	4.00	-
19	1	2.10	2.38	1.43	0.95	0.95	-
19	2	2.05	5.37	4.39	0.98	0.98	-
19	3	1.55	3.87	3.23	-	-	-
27	1	3.52	3.13	2.27	0.57	0.28	0.28
27	2	2.50	1.20	0.80	-	-	-
27	3	0.50	4.00	-	-	-	-
30	1	2.52	5.17	5.17	-	-	-
30	2	1.50	3.33	3.33	-	-	-
30	3	1.52	-	-	-	-	-
51	1	1.50	3.33	2.00	1.33	-	1.33
51	2	1.50	0.67	-	0.67	-	-
51	3	1.52	1.98	0.66	1.32	1.32	-
53	1	2.33	0.43	0.43	-	-	-
53	2	1.98	3.03	3.03	-	-	-

Table 1 (cont'd)

Site	Depth interval	Effort (h)	CPUE				
			Total	LC	RF	QB	CO
RESEARCH GEAR							
3	1	1.48	7.42	0.67	3.37	0.67	2.70
3	2	0.93	6.43	-	3.21	1.07	-
3	3	0.60	3.33	-	1.67	-	-
7	1	2.55	8.24	1.96	5.10	3.92	1.18
7	2	1.05	4.76	1.84	0.95	-	-
7	3	1.00	4.00	-	4.00	4.00	-
12	1	2.00	11.00	0.50	10.50	8.50	2.00
12	2	0.52	1.94	-	1.94	1.94	-
12	3	1.62	3.09	-	3.09	2.47	-
13	1	1.53	2.61	0.65	1.30	1.30	-
13	2	1.40	-	-	-	-	-
13	3	1.37	6.59	-	3.66	3.66	-
15	1	2.05	12.20	-	10.73	5.37	5.37
15	2	1.13	13.24	-	11.47	10.59	0.88
15	3	0.32	9.47	-	9.47	9.47	-
19	1	1.97	6.10	-	5.59	2.54	3.05
19	2	1.92	5.13	-	4.62	4.10	0.51
19	3	1.45	0.69	-	1.38	1.38	-
27	1	3.90	5.13	-	5.13	1.54	3.59
27	2	2.48	-	-	0.40	0.40	-
30	1	2.45	3.27	-	2.86	0.41	2.45
30	2	1.52	1.98	-	1.98	1.98	-
30	3	1.45	3.45	-	2.76	2.07	-
51	1	1.53	5.22	-	5.22	0.65	4.57
51	2	1.50	0.67	-	1.33	0.67	0.67
51	3	1.45	8.28	-	8.28	7.59	-
53	1	2.27	2.65	-	2.65	-	2.65
53	2	2.42	3.72	0.41	2.90	2.90	-
53	3	1.63	3.67	-	2.45	2.45	-

Table 2. Species composition for the all-gear catch during the survey, summarized by depth and site. LC lingcod, QB quillback rockfish, CO copper rockfish, YE yelloweye rockfish, GS greenstripe rockfish, TI tiger rockfish, KG kelp greenling, IL red Irish lord, CA cabezon, DF dogfish, RS rock sole, SS speckled sanddab, ES English sole and NF number of fish caught.

Site	LC	QB	CO	YE	GS	TI	KG	IL	CA	DF	RS	SS	ES	NF
5-27 m														
3	0.57	0.03	0.13	-	-	-	0.07	-	-	0.20	-	-	-	30
7	0.70	0.19	0.06	-	-	-	0.02	-	-	0.04	-	-	-	54
12	0.30	0.57	0.13	-	-	-	-	-	-	-	-	-	-	30
13	0.80	0.15	-	-	-	-	-	-	-	-	-	-	-	20
15	0.20	0.31	0.31	-	-	0.03	0.09	-	0.03	-	0.03	-	-	35
19	0.18	0.41	0.35	-	-	-	-	-	0.06	-	-	-	-	17
27	0.26	0.23	0.48	-	-	-	-	-	0.03	-	-	-	-	31
30	0.62	0.05	0.29	-	-	-	-	-	-	-	-	-	-	21
51	0.23	0.08	0.69	-	-	-	-	-	-	-	-	-	-	13
53	0.14	-	0.86	-	-	-	-	-	-	-	-	-	-	7
28-45 m														
3	0.12	0.06	-	0.12	-	-	-	-	-	0.71	-	-	-	17
7	0.33	-	-	0.11	-	-	-	-	-	0.56	-	-	-	9
12	-	1.00	-	-	-	-	-	-	-	-	-	-	-	1
13	0.50	-	-	-	-	-	-	-	-	0.50	-	-	-	2
15	0.36	0.48	0.04	-	-	-	-	0.04	0.04	-	-	-	-	25
19	0.43	0.48	0.05	-	-	-	0.05	-	-	-	-	-	-	21
27	0.67	0.33	-	-	-	-	-	-	-	0.33	-	-	-	3
30	0.63	0.38	-	-	-	-	-	-	-	-	-	-	-	8
51	-	0.50	0.50	-	-	0.50	-	-	-	-	-	-	-	2
53	0.47	0.47	-	-	-	-	-	-	-	-	0.07	-	-	15
46-55 m														
3	0.17	-	-	0.33	-	-	-	-	-	0.50	-	-	-	6
7	0.50	0.50	-	-	-	-	-	-	-	-	-	-	-	8
12	0.21	0.29	-	0.14	-	-	-	-	-	0.36	-	-	-	14
13	-	0.36	-	-	-	-	-	-	-	0.43	-	-	0.14	14
15	-	1.00	-	-	-	-	-	-	-	-	-	-	-	5
19	0.71	0.29	-	-	-	-	-	-	0.14	-	-	-	-	7
27	-	-	-	-	-	-	-	-	-	0.50	-	-	-	2
30	-	0.60	-	0.20	-	-	-	-	-	0.20	-	-	-	5
51	0.07	0.87	-	-	0.07	-	-	-	-	-	-	-	-	15
53	0.18	0.45	-	-	-	-	-	-	-	0.18	0.09	0.09	-	11

Table 3. Species composition (%) and the effect of fishing method and depth on species composition.

DEPTH

a. Commercial Gear

Depth	LC	QB/CO	N	
1	93.9	6.1	114	chi-square=7.9
2	94.6	5.4	37	df=2, p<0.025
3	76.2	23.8	21	
N	158	14	172	

b. Research Gear

Depth	QB	CO	N	
1	47.0	53.0	115	chi-square=48.4
2	91.9	8.1	37	df=2, p<0.001
3	100.0	0	36	
N	124	64	188	

GEAR TYPE

a. 5-27 m.

Gear Type	LC	QB	CO	N	
commercial	93.9	3.5	2.6	114	chi-square=180.9
research	6.5	43.9	49.6	123	df=2, p<0.001
N	115	58	64	237	

b. 2-45 m.

Gear Type	LC	QB/CO	N	
commercial	94.6	5.4	37	chi-square=59.9
research	7.5	92.5	40	df=1, p<0.001
N	38	39	77	

c. 46-55 m.

Gear Type	LC	QB	N	
commercial	10.3	23.8	21	chi-square=38.1
research	0	100.0	36	df=1, p<0.001
N	16	41	57	

Table 4. Mean fork length and weight with one standard error for lingcod and quillback, copper and yelloweye rockfish, by sex and gear type.

	Males					Females				
Species	n	Length (cm)	SE	Weight (kg)	SE	n	Length (cm)	SE	Weight (kg)	SE
Commercial Gear										
Lingcod	37	61.1	1.10	2.4	0.14	107	72.5	0.94	4.3	0.20
Quillback	2	34.2	0.80	0.8	0.03	9	36.8	1.51	1.0	0.12
Copper	2	37.7	7.75	1.2	0.71	0	-	-	-	-
Yelloweye	1	48.3	-	2.1	-	1	64.0	-	5.4	-
Research Gear										
Lingcod	4	54.6	1.61	1.6	0.25	6	62.9	5.04	2.8	0.72
Quillback	52	32.1	0.63	0.7	0.04	70	33.2	0.56	0.8	0.04
Copper	24	32.6	0.92	0.6	0.06	37	32.6	0.65	0.7	0.04
Yelloweye	4	39.1	5.08	1.3	0.47	2	28.6	4.70	0.4	0.19

Table 5. Parameter estimates for the weight-length (g-cm) relationship $W=aL^b$, by species with the coefficient of determination (r^2) and mean square error, as calculated from the linear regression log(weight)=log(a)+b*log(length).

Species	Sex	N	a	b	r^2	M.S.E.
Lingcod	M	40	0.0032	3.278	0.966	0.030
	F	112	0.0028	3.307	0.946	0.049
Quillback Rockfish	comb.	132	0.0170	3.041	0.953	0.043
Copper Rockfish	comb.	63	0.0194	2.982	0.937	0.046

Table 6. Frequency of different maturity stages for male and female lingcod and rockfish caught during the survey. Maturity codes are described in Appendix table 4.

Species	Maturity stage	Male		Female	
		n	%	n	%
Lingcod	2	2	5	26	23
	3	2	5	0	-
	4	10	24	0	-
	5	0	-	8	7
	6	0	-	16	14
	7	13	32	21	19
	8	14	34	37	33
	9	0	-	5	4
Quillback	1	11	20	6	8
	2	0	-	15	19
	3	0	-	54	69
	4	3	6	3	4
	7	40	74	0	-
Copper	1	1	4	1	3
	2	0	-	8	22
	3	0	-	23	62
	4	2	8	4	11
	7	23	88	-	-
	8	0	-	1	3

Table 7. Inter-year comparisons of lingcod statistics.

	YEAR			
	1985	1986	1987	1988
Lingcod CPUE (fish/hr)	9.4	-	4.1	3.2
CPUE of male lingcod	3.7	-	1.0	0.8
CPUE of female lingcod	5.4	-	2.6	2.2
Lingcod CPUE (kg/dy)				
from survey[1]	195	-	83	81
from sales slips	132	103	84	84
% lingcod in total catch	70	-	45	38
ratio of male:female	40:60	-	30:70	27:73

[1]Numbers converted to kg according to the average weight in that year. An average day-length of 6.5 hours was obtained from harvest log data (Hand and Richards 1988).

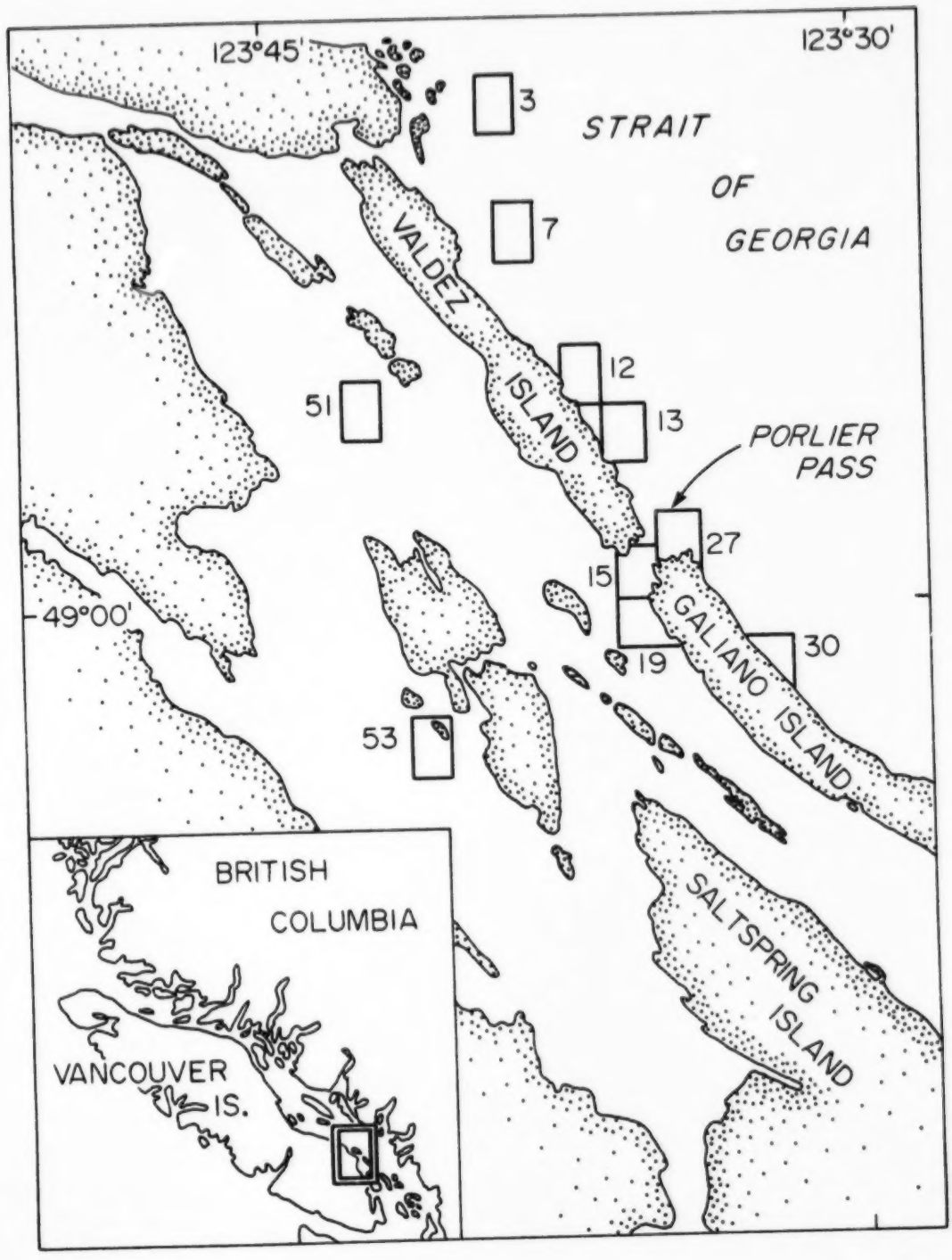

Fig. 1. Locations of lingcod survey sites, January and February, 1988.

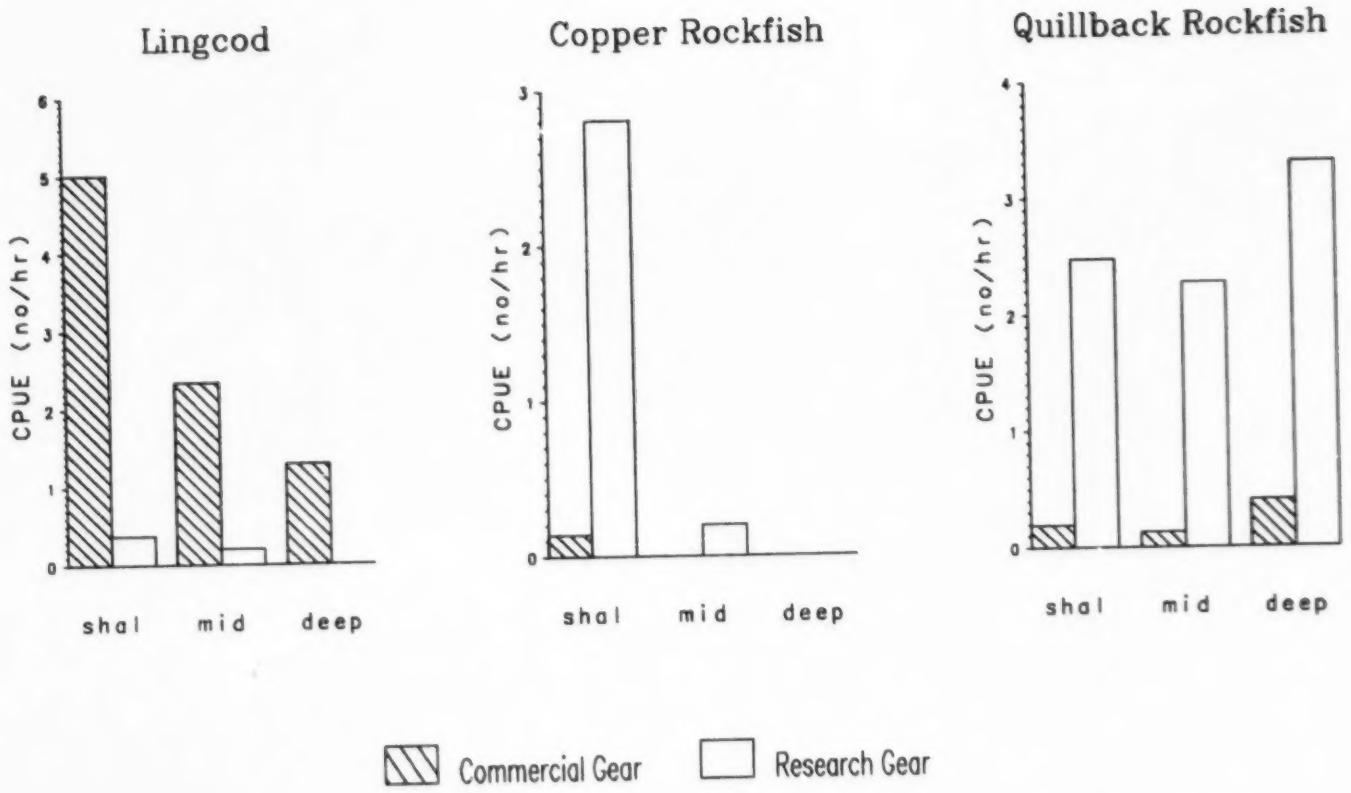

Fig. 2. Catch per unit effort (no./h) by depth interval and gear type for lingcod and quillback and copper rockfish. Depth intervals; shal 5-27 m, mid 28-45 m, deep 46-55 m.

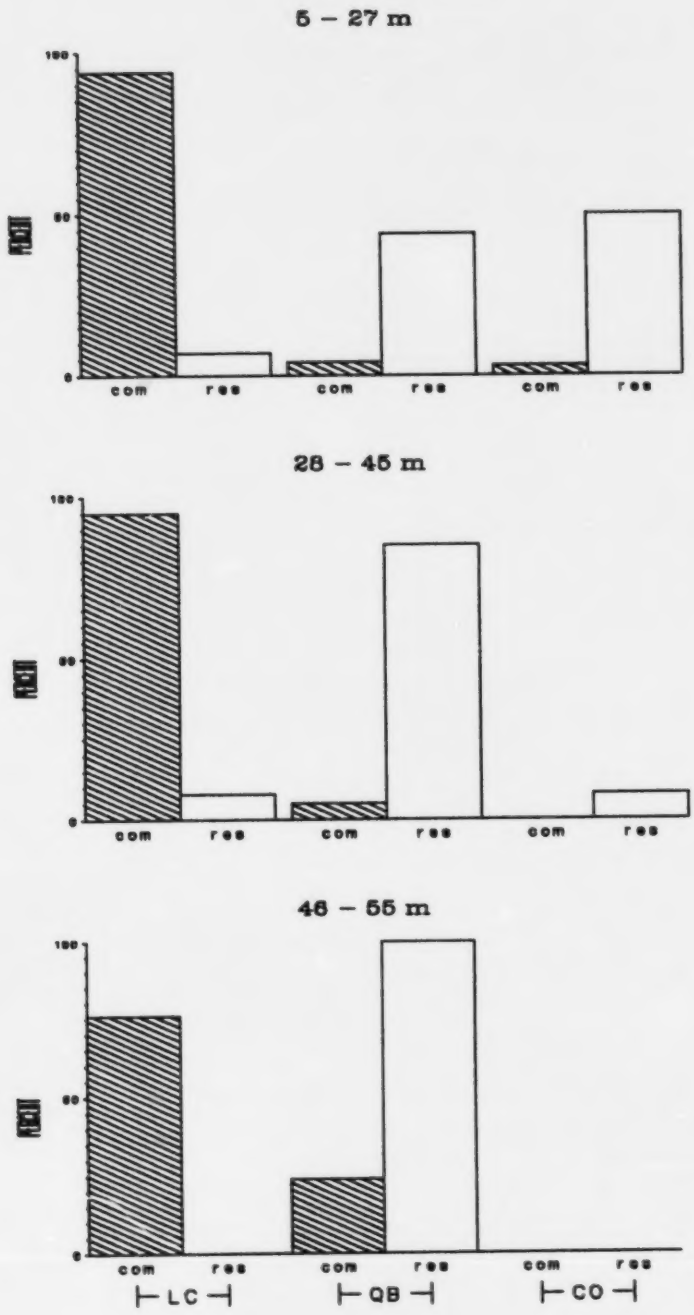

Fig. 3. Species composition (%) by depth interval and gear type for LC lingcod, QB quillback rockfish and CO copper rockfish. Gear type; com=commercial gear, res=research gear.

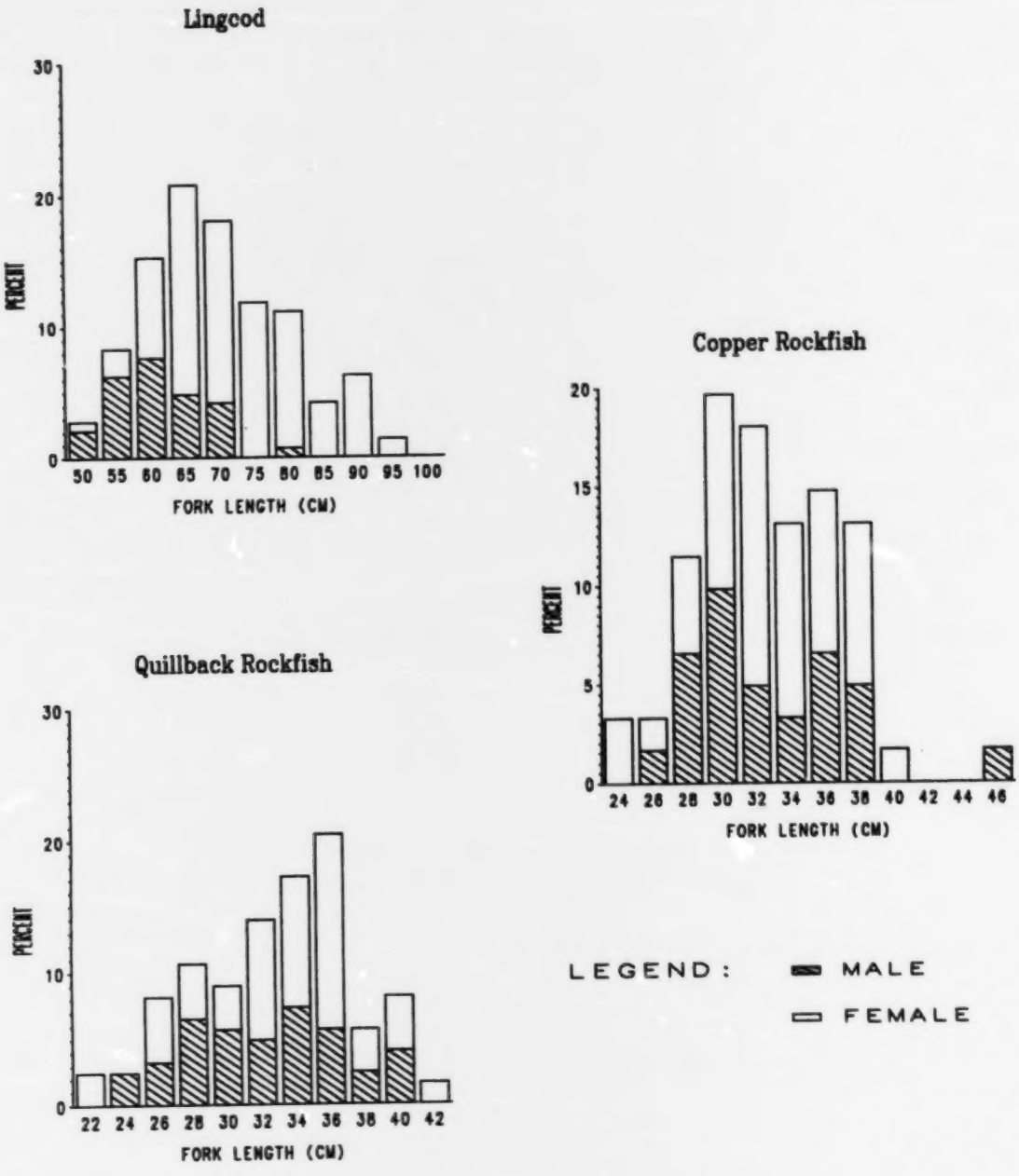

Fig. 4. Length-frequency histograms for lingcod, caught with commercial gear, and quillback and copper rockfish, caught with research gear. Lengths shown represent the midpoint of the size interval.

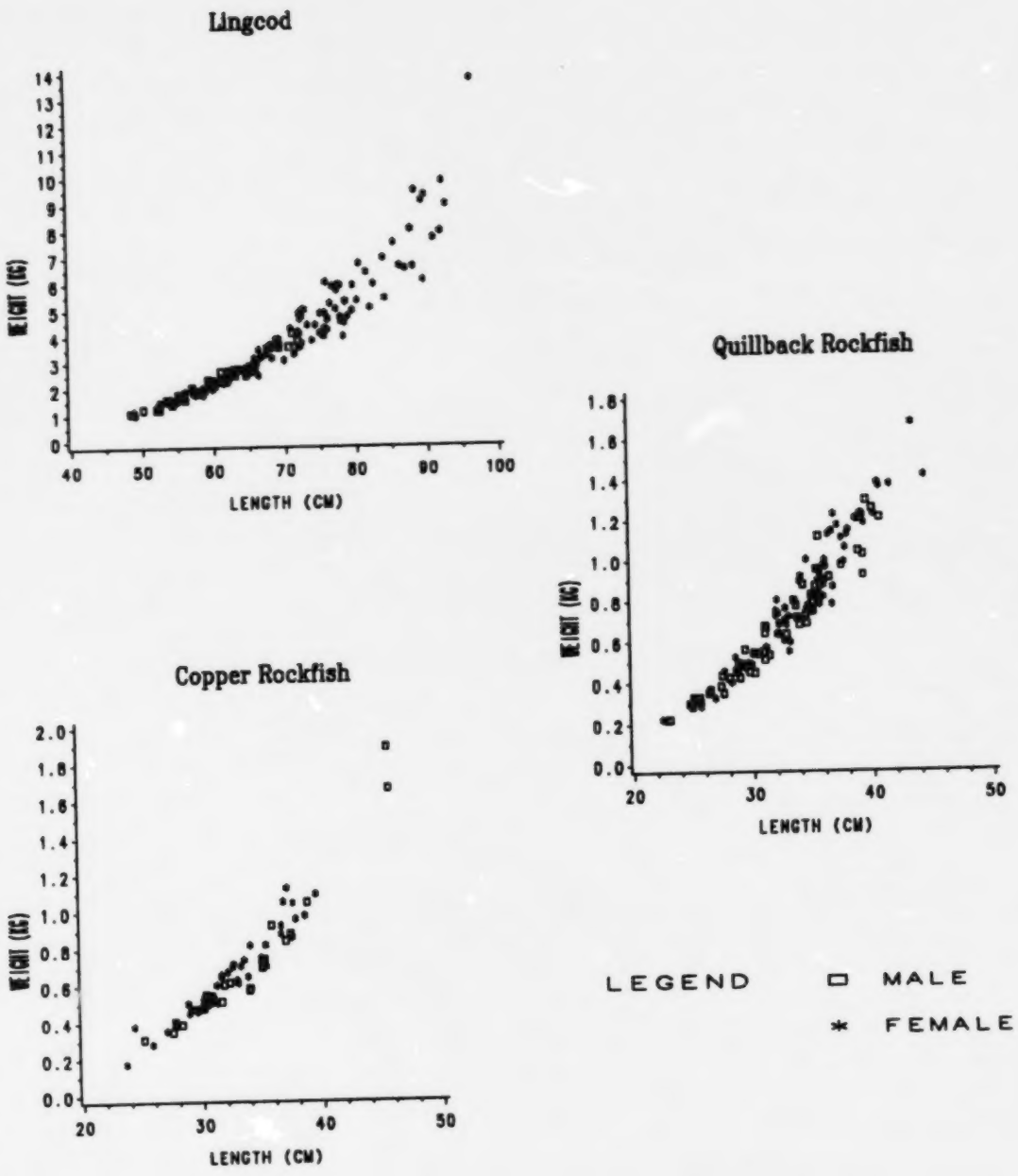

Fig. 5. The relationship between weight (kg) and length (cm) for lingcod and quillback and copper rockfish.

Appendix Table 1. Summary of set information from the Strait of Georgia lingcod survey in Dec-Feb, 1987/1988. Codes for depth, gear, sun, sea state, tide and current are described in Appendix table 2. REC = record. Species codes: LC lingcod, QB quillback rockfish, CO copper rockfish, YE yelloweye rockfish, GS greenstripe rockfish, TI tiger rockfish, KG kelp greenling, CA cabezon, DF spiny dogfish, RS rock sole, ES English sole, SS speckled sanddab.

										EFFORT	Species (No. of fish)											
REC	DATE	SITE	DEPTH	GEAR	SUN	SEA	TIDE	CURR	TIME	(h)	LC	QB	CO	YE	GS	TI	KG	CA	DF	RS	ES	SS	Total
1	871211	53	1	comm	1	1	+3	1	1005	0.40	.	.	.	.	.	.	.	.	.	.	.	.	0
1	871211	53	1	res	1	1	+3	1	1005	0.33	.	.	.	.	.	.	.	.	.	.	.	.	0
2	871211	53	2	comm	1	1	+3	1	1025	0.50	2	.	.	.	.	.	.	.	.	.	.	.	2
2	871211	53	2	res	1	1	+3	1	1025	0.57	.	1	.	.	.	.	.	.	.	.	.	.	1
3	871211	53	3	comm	1	1	+3	1	1115	0.43	.	.	.	.	.	.	.	.	1	.	.	.	1
3	871211	53	3	res	1	1	+3	1	1115	0.37	.	1	.	.	.	.	.	.	.	.	.	.	1
4	871211	53	1	comm	1	1	+3	1	1155	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
4	871211	53	1	res	1	1	+3	1	1155	0.37	.	.	1	.	.	.	.	.	.	.	.	.	1
5	871211	53	2	comm	1	1	00	1	1240	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
5	871211	53	2	res	1	1	00	1	1240	0.42	.	1	.	.	.	.	.	.	.	.	.	.	1
6	871211	53	3	comm	3	1	00	1	1310	0.53	.	.	.	.	.	.	.	.	1	.	.	.	1
6	871211	53	3	res	3	1	00	1	1310	0.35	.	1	.	.	.	.	.	.	.	.	.	.	1
7	871211	53	1	comm	3	1	00	1	1340	0.43	.	.	.	.	.	.	.	.	.	.	.	.	0
7	871211	53	1	res	3	1	00	1	1340	0.53	.	.	1	.	.	.	.	.	.	.	.	.	1
8	871211	53	2	comm	1	1	00	1	1420	0.48	2	.	.	.	.	.	.	.	.	.	.	.	2
8	871211	53	2	res	1	1	00	1	1426	0.45	.	1	.	.	.	.	.	.	.	.	.	.	1
9	871211	53	3	comm	1	1	00	1	1450	0.53	.	1	.	.	.	.	.	.	.	.	.	.	1
9	871211	53	3	res	1	1	00	1	1450	0.38	.	1	.	.	.	.	.	.	.	1	.	1	3
10	871215	19	1	comm	2	2	+2	2	1030	0.58	.	.	.	.	.	.	.	.	.	.	.	.	0
10	871215	19	1	res	2	2	+2	2	1030	0.48	.	.	.	.	.	.	.	1	.	.	.	.	1
11	871215	19	2	comm	2	2	+2	2	1100	0.48	6	.	.	.	.	.	.	.	.	.	.	.	6
11	871215	19	2	res	2	2	+2	2	1100	0.47	.	1	.	.	.	.	.	.	.	.	.	.	1
12	871215	19	3	comm	2	2	+2	1	1135	0.50	3	.	.	.	.	.	.	.	.	.	.	.	3
12	871215	19	3	res	2	2	+2	1	1135	0.45	.	.	.	.	.	.	.	.	.	.	.	.	0
13	871215	15	1	comm	2	2	+3	4	1235	0.55	3	.	.	.	.	.	.	1	.	.	.	.	4
13	871215	15	1	res	2	2	+3	4	1235	0.55	.	1	2	.	.	.	.	.	.	1	.	.	4
14	871215	15	2	comm	2	2	+3	3	1320	0.37	7	.	.	.	.	.	.	.	.	.	.	.	7
14	871215	15	2	res	2	2	+3	3	1320	0.27	.	2	.	.	.	.	.	.	.	.	.	.	2
15	871215	19	1	comm	2	2	+3	2	1405	0.50	1	1	.	.	.	.	.	.	.	.	.	.	2
15	871215	19	1	res	2	2	+3	2	1405	0.50	.	.	3	.	.	.	.	.	.	.	.	.	3
16	871215	19	2	comm	2	1	00	1	1445	0.53	1	1	.	.	.	.	.	.	.	.	.	.	2
16	871215	19	2	res	2	1	00	1	1445	0.53	.	1	.	.	.	.	.	.	.	.	.	.	1
17	871215	19	3	comm	2	1	00	2	1520	0.52	2	.	.	.	.	.	.	.	1	.	.	.	3
17	871215	19	3	res	2	1	00	2	1520	0.48	.	1	.	.	.	.	.	.	.	.	.	.	1
18	880108	27	1	comm	2	3	00	2	1045	0.52	1	.	.	.	.	.	.	.	.	.	.	.	1
18	880108	27	1	res	2	3	00	2	1045	0.50	.	.	4	.	.	.	.	.	.	.	.	.	4
19	880108	27	1	comm	2	4	00	2	1120	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
19	880108	27	1	res	2	4	00	2	1120	0.38	.	.	.	.	.	.	.	.	.	.	.	.	0
20	880108	51	1	comm	2	4	+1	3	1230	0.50	2	.	1	.	.	.	.	.	.	.	.	.	3
20	880108	51	1	res	2	4	+1	3	1230	0.50	.	.	3	.	.	.	.	.	.	.	.	.	3
21	880108	51	2	comm	2	4	+1	2	1310	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
21	880108	51	2	res	2	4	+1	2	1310	0.48	.	.	1	.	.	.	.	.	.	.	.	.	1

Appendix Table 1 (cont'd)

REC	DATE	SITE	DEPTH	GEAR	SUN	SEA	TIDE	CURR	TIME	EFFORT (h)	Species (No. of fish) LC	QB	CO	YE	GS	TI	KG	CA	DF	RS	ES	SS	Total
22	880108	51	3	comm	2	3	+2	2	1400	0.52	.	1	.	.	.	.	.	.	.	.	.	.	1
22	880108	51	3	res	2	3	+2	2	1400	0.43	.	4	.	.	.	.	.	.	.	.	.	.	4
23	880108	19	1	comm	2	2	+3	2	1520	0.52	1	1	.	.	.	.	.	.	.	.	.	.	2
23	880108	19	1	res	2	2	+3	2	1520	0.48	.	3	.	.	.	.	.	.	.	.	.	.	3
24	880108	19	2	comm	2	2	+3	3	1545	0.53	.	1	.	.	.	.	.	.	.	.	.	.	1
24	880108	19	2	res	2	2	+3	3	1545	0.45	.	3	.	.	.	.	1	.	.	.	.	.	4
25	880118	13	1	comm	2	3	+2	2	1025	0.47	6	.	.	.	.	.	.	.	.	.	.	.	6
25	880118	13	1	res	2	3	+2	2	1025	0.48	1	1	.	.	.	.	.	.	.	.	.	.	2
26	880118	13	2	comm	2	3	+3	2	1055	0.50	1	.	.	.	.	.	.	.	.	.	.	.	1
26	880118	13	2	res	2	3	+3	2	1055	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
27	880118	13	3	comm	3	2	+3	2	1125	0.50	.	.	.	.	.	.	.	.	4	.	.	.	4
27	880118	13	3	res	3	2	+3	2	1125	0.40	.	.	.	.	.	.	.	.	1	.	2	.	3
28	880118	12	1	comm	3	2	+3	2	1215	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
28	880118	12	1	res	3	2	+3	2	1215	0.50	.	.	4	.	.	.	.	.	.	.	.	.	4
29	880118	12	2	comm	3	2	+3	2	1245	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
29	880118	12	2	res	3	2	+3	2	1245	0.52	.	1	.	.	.	.	.	.	.	.	.	.	1
30	880118	12	3	comm	3	2	+3	2	1315	0.27	.	.	.	.	.	.	.	.	3	.	.	.	3
30	880118	12	3	res	3	2	+3	2	1315	0.28	.	.	.	.	.	.	.	.	.	.	.	.	0
31	880118	13	2	comm	1	2	+3	2	1345	0.43	.	.	.	.	.	.	.	.	.	.	.	.	0
31	880118	13	2	res	1	2	+3	2	1345	0.40	.	.	.	.	.	.	.	.	.	.	.	.	0
32	880118	13	1	comm	3	1	00	1	1405	0.50	8	.	.	.	.	.	.	.	.	.	.	.	8
32	880118	13	1	res	3	1	00	1	1405	0.50	.	.	.	.	.	.	.	.	.	.	.	.	1
33	880118	13	3	comm	2	1	00	1	1435	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
33	880118	13	3	res	2	1	00	1	1435	0.50	.	5	.	.	.	.	.	.	.	.	.	.	5
34	880121	30	1	comm	3	2	00	2	1050	0.52	1	.	.	.	.	.	.	.	.	.	.	.	1
34	880121	30	1	res	3	2	00	.	1050	0.50	.	.	1	.	.	.	.	.	.	.	.	.	1
35	880121	30	2	comm	1	2	+1	2	1115	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
35	880121	30	2	res	1	2	+1	2	1115	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
36	880121	30	3	comm	1	3	+1	3	1140	0.52	.	.	.	.	.	.	.	.	.	.	.	.	0
36	880121	30	3	res	1	3	+1	3	1140	0.50	.	.	.	1	.	.	.	.	.	.	.	.	1
37	880121	30	1	comm	3	3	+2	2	1210	0.50	3	.	.	.	.	.	.	.	.	.	.	.	3
37	880121	30	1	res	3	3	+2	2	1210	0.50	.	.	.	.	.	.	.	.	.	.	.	.	1
38	880121	30	2	comm	2	3	+2	2	1300	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
38	880121	30	2	res	2	3	+2	2	1300	0.52	.	1	.	.	.	.	.	.	.	.	.	.	1
39	880121	30	3	comm	2	3	+3	2	1330	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
39	880121	30	3	res	2	3	+3	2	1330	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
40	880121	27	1	comm	2	2	+3	3	1410	0.50	3	.	.	.	.	.	.	1	.	.	.	.	4
40	880121	27	1	res	2	2	+3	3	1410	0.52	.	2	1	.	.	.	.	.	.	.	.	.	3
41	880121	27	2	comm	2	2	+3	3	1440	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
41	880121	27	2	res	2	2	+3	3	1440	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
42	880125	7	1	comm	1	2	00	2	1130	0.40	10	.	.	.	.	.	.	.	.	.	.	.	10
42	880125	7	1	res	1	2	00	2	1130	0.52	1	3	.	.	.	.	.	.	.	.	.	.	4
43	880125	7	2	comm	1	2	00	3	1155	0.50	1	.	.	.	.	.	.	.	.	.	.	.	1

Appendix Table 1 (cont'd)

REC	DATE	SITE	DEPTH	GEAR	SUN	SEA	TIDE	CURR	TIME	EFFORT (h)	Species (No. of fish) LC	QB	CO	YE	GS	TI	KG	CA	DF	RS	ES	SS	Total
43	880125	7	2	res	1	2	00	3	1155	0.48	1	.	.	1	.	.	.	.	.	.	.	.	2
44	880125	7	3	comm	2	2	00	3	1230	0.50	4	.	.	.	.	.	.	.	.	.	.	.	4
44	880125	7	3	res	2	2	00	3	1230	0.50	.	1	.	.	.	.	.	.	.	.	.	.	1
45	880125	7	1	comm	2	1	00	2	1255	0.50	4	.	.	.	.	.	.	.	.	.	.	.	4
45	880125	7	1	res	2	1	00	2	1255	0.52	.	3	.	.	.	.	.	.	1	.	.	.	4
46	880125	7	2	comm	2	1	00	2	1330	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
46	880125	7	2	res	2	1	00	2	1330	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
47	880125	7	3	comm	2	2	+1	2	1405	0.52	.	.	.	.	.	.	.	.	.	.	.	.	0
47	880125	7	3	res	2	2	+1	2	1405	0.50	.	3	.	.	.	.	.	.	.	.	.	.	3
48	880125	12	1	comm	2	1	+1	3	144	0.52	5	.	.	.	.	.	.	.	.	.	.	.	5
48	880125	12	1	res	2	1	+1	3	1445	0.50	1	7	.	.	.	.	.	.	.	.	.	.	8
49	880125	12	3	comm	2	1	+2	3	1525	0.50	2	.	.	.	.	.	.	.	.	.	.	.	2
49	880125	12	3	res	2	1	+2	3	1525	0.50	.	2	.	.	.	.	.	.	.	.	.	.	2
50	880125	12	3	comm	2	1	+2	2	1550	0.48	1	.	.	1	.	.	.	.	.	.	.	.	2
50	880125	12	3	res	2	1	+2	2	1550	0.33	.	2	.	1	.	.	.	.	.	.	.	.	3
51	880126	3	1	comm	2	1	00	2	1015	0.50	5	.	.	.	.	.	.	.	.	.	.	.	5
51	880126	3	1	res	2	1	00	2	1010	0.50	1	1	1	.	.	.	.	.	.	.	.	.	3
52	880126	3	2	comm	2	1	+1	2	1145	0.28	1	.	.	.	.	.	.	.	2	.	.	.	3
52	880126	3	2	res	2	1	+1	2	1145	0.28	.	.	.	.	.	.	.	.	2	.	.	.	2
53	880126	3	3	comm	2	1	+1	3	1215	0.50	1	.	.	1	.	.	.	.	.	.	.	.	2
53	880126	3	3	res	2	2	+1	3	1215	0.48	.	.	.	1	.	.	.	.	.	.	.	.	1
54	880126	3	1	comm	2	2	+1	3	1305	0.50	2	.	.	.	.	.	.	.	.	.	.	.	2
54	880126	3	1	res	2	2	+1	3	1305	0.48	.	.	1	.	.	.	1	.	.	.	.	.	2
55	880126	3	2	comm	1	3	+1	4	1345	0.32	.	.	.	.	.	.	.	.	4	.	.	.	4
56	880126	3	3	comm	2	2	+1	3	1430	0.08	.	.	.	.	.	.	.	.	2	.	.	.	2
56	880126	3	3	res	2	2	+1	3	1430	0.12	.	.	.	.	.	.	.	.	1	.	.	.	1
57	880126	7	1	comm	2	2	+1	1	1445	0.50	7	.	.	.	.	.	.	.	.	.	.	.	7
57	880126	7	1	res	2	2	+1	1	1450	0.50	.	3	2	.	.	.	.	.	.	.	.	.	5
58	880201	15	1	comm	2	2	+1	3	1040	0.50	3	.	.	.	.	.	.	.	.	.	.	.	3
58	880201	15	1	res	2	2	+1	3	1040	0.50	.	3	5	.	.	.	2	.	.	.	.	.	10
59	880201	19	2	comm	3	2	+1	2	1130	0.50	2	.	.	.	.	.	.	.	.	.	.	.	2
59	880201	19	2	res	3	2	+1	12	1130	0.50	.	3	1	.	.	.	.	.	.	.	.	.	4
60	880201	19	1	comm	3	1	+1	2	1240	0.50	1	.	.	.	.	.	.	.	.	.	.	.	1
60	880201	19	1	res	3	1	+1	2	1240	0.50	.	2	3	.	.	.	.	.	.	.	.	.	5
61	880201	19	3	comm	3	1	+1	2	1310	0.53	.	.	.	.	.	.	.	.	.	.	.	.	0
61	880201	19	3	res	3	1	+1	2	1312	0.52	.	1	.	.	.	.	.	.	.	.	.	.	0
62	880201	15	2	comm	2	1	+2	2	1340	0.50	2	.	.	.	.	.	.	1	.	.	.	.	3
62	880201	15	2	res	2	1	+2	2	1340	0.40	.	6	.	.	.	.	.	.	.	.	.	.	6
63	880201	15	1	comm	2	2	+2	3	1440	0.50	1	.	.	.	.	1	1	.	.	.	.	.	3
63	880201	15	1	res	2	2	+2	3	1440	0.50	.	7	2	.	.	.	.	.	.	.	.	.	9
64	880201	15	2	comm	2	2	+3	4	1505	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
64	880201	15	2	res	2	2	+3	4	1505	0.47	.	4	1	.	.	.	.	.	.	.	.	.	5
65	880203	13	1	comm	2	3	+1	2	1215	0.52	1	1	.	.	.	.	.	.	.	.	.	.	2
65	880203	13	1	res	2	3	+1	2	1215	0.55	.	1	.	.	.	.	.	.	.	.	.	.	1

Appendix Table 1 (cont'd

REC	DATE	SITE	DEPTH	GEAR	SUN	SEA	TIDE	CURR	TIME	EFFORT (h)	Species (No. of fish)											
											LC	QB	CO	YE	GS	TI	KG	CA	DF	RS	ES	SS Total
66	880203	13	2	comm	2	2	+1	2	1245	0.50	.	.	.	.	.	.	.	.	1	.	.	. 1
66	880203	13	2	res	2	2	+1	2	1245	0.50	.	.	.	.	.	.	.	.	.	.	.	. 0
67	880203	13	3	comm	2	2	+1	2	1310	0.47	.	.	.	.	.	.	.	.	1	.	.	. 1
67	880203	13	3	res	2	2	+1	2	1310	0.47	.	.	.	.	.	.	.	.	.	.	.	. 1
68	880203	27	1	comm	2	2	+1	3	1355	0.50	1	.	.	.	.	.	.	.	.	.	.	. 1
68	880203	27	1	res	2	2	+1	2	1355	0.50	.	2	.	.	.	.	.	.	.	.	.	. 2
69	880203	27	2	comm	2	1	+1	4	1425	0.50	2	.	.	.	.	.	.	.	.	.	.	. 2
69	880203	27	2	res	2	1	+1	4	1425	0.50	.	.	.	.	.	.	.	.	.	.	.	. 0
70	880203	27	3	comm	2	1	+2	3	1455	0.50	.	.	.	.	.	.	.	.	1	.	.	. 2
70	880203	27	3	res	2	1	+2	3	1440	0.50	.	.	.	.	.	.	.	.	.	.	.	. 0
71	880203	27	1	comm	2	1	+2	3	1525	0.50	1	.	1	.	.	.	.	.	.	.	.	. 2
71	880302	27	1	res	2	1	+2	3	1525	0.50	.	1	4	.	.	.	.	.	.	.	.	. 5
72	880203	27	2	comm	2	1	+2	3	1610	0.50	.	.	.	.	.	.	.	.	1	.	.	. 1
72	880203	27	2	res	2	1	+2	3	1610	0.50	.	.	.	.	.	.	.	.	.	.	.	. 0
73	880208	30	1	comm	2	3	+3	2	1100	0.50	5	.	.	.	.	.	.	.	.	.	.	. 5
73	880208	30	1	res	2	3	+3	2	1100	0.50	.	.	2	.	.	.	.	.	.	.	.	. 2
74	880208	30	2	comm	2	3	+3	3	1135	0.50	5	.	.	.	.	.	.	.	.	.	.	. 5
74	880208	30	2	res	2	3	+3	3	1135	0.50	.	2	.	.	.	.	.	.	.	.	.	. 2
75	880208	30	3	comm	4	3	+3	3	1205	0.52	.	.	.	.	.	.	.	.	.	.	.	. 0
75	880208	30	3	res	4	3	+3	3	1200	0.45	.	3	.	.	.	.	.	.	1	.	.	. 4
76	880208	30	1	comm	4	3	00	2	1255	0.50	3	.	.	.	.	.	.	.	.	.	.	. 3
76	880208	30	1	res	4	3	00	2	1255	0.50	.	.	3	.	.	.	.	.	.	.	.	. 3
77	880208	30	1	comm	4	3	00	2	1325	0.50	1	.	.	.	.	.	.	.	.	.	.	. 1
77	880208	30	1	res	4	3	00	2	1325	0.45	.	1	.	.	.	.	.	.	.	.	.	. 1
78	880208	15	3	comm	4	3	00	4	1405	0.50	.	2	.	.	.	.	.	.	.	.	.	. 2
78	880208	15	3	res	4	3	00	4	1405	0.32	.	3	.	.	.	.	.	.	.	.	.	. 3
79	880208	15	1	comm	4	2	+1	2	1440	0.50	.	.	.	.	.	.	.	.	.	.	.	. 0
80	880210	53	1	comm	2	3	+3	2	1100	0.50	1	.	.	.	.	.	.	.	.	.	.	. 1
80	880210	53	1	res	2	3	+3	2	1100	0.50	.	.	.	.	.	.	.	.	.	.	.	. 0
81	880210	53	2	comm	2	3	+3	3	1125	0.50	2	.	.	.	.	.	.	.	.	.	.	. 2
81	880210	53	2	res	2	3	+3	3	1125	0.48	1	3	.	.	.	.	.	.	.	.	.	. 4
82	880210	53	1	comm	2	3	+3	3	1230	0.50	.	.	.	.	.	.	.	.	.	.	.	. 0
82	880210	53	1	res	2	3	+3	3	1230	0.53	.	.	4	.	.	.	.	.	.	.	.	. 4
83	880210	53	2	res	2	3	+3	3	1320	0.50	.	1	.	.	.	.	.	.	.	1	.	. 2
84	880210	53	3	comm	2	2	00	2	1355	0.50	2	.	.	.	.	.	.	.	.	.	.	. 2
84	880210	53	3	res	2	2	00	2	1355	0.53	.	1	.	.	.	.	.	.	.	.	.	. 1
85	880215	7	1	comm	3	2	+1	3	1120	0.50	1	.	.	.	.	.	.	.	.	.	.	. 1
85	880215	7	1	res	3	2	+1	3	1120	0.48	1	.	1	.	.	.	.	.	.	.	.	. 2
86	880215	3	1	comm	1	4	+1	3	1205	0.50	9	.	.	.	.	.	.	.	3	.	.	. 12
86	880215	3	1	res	1	4	+1	3	1205	0.50	.	.	2	.	.	.	1	.	3	.	.	. 6
87	880215	3	2	comm	1	3	+2	3	1335	0.40	1	.	.	.	.	.	.	.	3	.	.	. 4
87	880215	3	2	res	1	3	+2	3	1335	0.32	.	1	.	.	.	.	.	.	1	.	.	. 2
88	880215	7	2	comm	3	3	+3	2	1410	0.13	.	.	.	.	.	.	.	.	3	.	.	. 3

Appendix Table 1 (cont'd)

REC	DATE	SITE	DEPTH	GEAR	SUN	SEA	TIDE	CURR	TIME	EFFORT (h)	Species (No. of fish) LC	QB	CO	YE	GS	TI	KG	CA	DF	RB	ES	SS	Total
88	880215	7	2	res	3	3	+3	2	1410	0.07	1	.	.	.	.	.	.	.	2	.	.	.	3
89	880215	7	1	comm	3	3	+3	2	1420	0.43	11	.	.	.	.	.	.	.	.	.	.	.	11
89	880215	7	1	res	3	3	+3	2	1420	0.53	3	1	.	.	.	.	1	.	1	.	.	.	6
90	880216	12	1	comm	2	2	+1	2	1150	0.50	3	.	.	.	.	.	.	.	.	.	.	.	3
90	880216	12	1	res	2	2	+1	2	1150	0.48	.	7	.	.	.	.	.	.	.	.	.	.	7
91	880216	12	1	comm	2	2	+1	2	1220	0.52	.	.	.	.	.	.	.	.	.	.	.	.	0
91	880216	12	1	res	2	2	+1	2	1220	0.52	.	3	.	.	.	.	.	.	.	.	.	.	3
92	880216	12	3	comm	2	2	+1	2	1245	0.50	.	.	.	.	.	.	.	.	2	.	.	.	2
92	880216	12	3	res	2	2	+1	2	1245	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
93	880216	27	2	comm	2	2	+1	1	1340	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
93	880216	27	2	res	2	2	+1	1	1340	0.48	.	1	.	.	.	.	.	.	.	.	.	.	0
94	880216	27	1	comm	2	2	+2	3	1405	0.50	2	1	.	.	.	.	.	.	.	.	.	.	3
94	880216	27	1	res	2	2	+2	3	1405	0.50	.	1	2	.	.	.	.	.	.	.	.	.	3
95	880216	27	1	comm	2	2	+2	2	1435	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
95	880216	27	1	res	2	2	+2	2	1436	0.50	.	.	3	.	.	.	.	.	.	.	.	.	3
96	880216	27	2	comm	1	2	+2	2	1500	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
96	880216	27	2	res	1	2	+2	2	1500	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
97	880218	51	1	comm	2	2	+3	2	1025	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
97	880218	51	1	res	2	2	+3	2	1025	0.52	.	1	2	.	.	.	.	.	.	.	.	.	3
98	880218	51	2	comm	2	2	00	3	1055	0.50	.	.	.	.	.	1	.	.	.	.	.	.	1
98	880218	51	2	res	2	2	00	3	1055	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
99	880218	51	3	comm	2	2	+1	2	1125	0.50	1	1	.	.	.	.	.	.	.	.	.	.	2
99	880218	51	3	res	2	2	+1	2	1125	0.52	.	2	.	.	1	.	.	.	.	.	.	.	3
100	880218	51	1	comm	2	2	+1	2	1230	0.50	1	.	1	.	.	.	.	.	.	.	.	.	2
100	880218	51	1	res	2	2	+1	2	1230	0.52	.	.	2	.	.	.	.	.	.	.	.	.	2
101	880218	51	2	comm	2	1	+2	2	1300	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
101	880218	51	2	res	2	1	+2	2	1300	0.52	.	1	.	.	.	.	.	.	.	.	.	.	0
102	880218	51	3	comm	2	1	+2	1	1325	0.50	.	.	.	.	.	.	.	.	.	.	.	.	0
102	880218	51	3	res	2	1	+2	1	1325	0.50	.	5	.	.	.	.	.	.	.	.	.	.	5

Appendix Table 2. Codes used to describe depth, gear, sun, sea state, tide and current during lingcod survey.

Depth	1	5-27 m (3-15 fa)
	2	28-46 m (16-25 fm)
	3	47-55 m (26-30 fm)
Gear	comm	standard commercial lingcod handline method with live 15-20-cm bait herring and double Mustad #93664 size-6 hooks and 23-kg-test monofilament line and steel leader.
	res	standard research hook and line method using 12-cm (5-inch) frozen bait herring and two single Mustad #92553 size 3/0 hooks and 9-kg-test monofilament line with 7-kg-test leader.
Sun	1	bright
	2	dull or overcast
	3	variable
	4	rain
Sea state	1	calm
	2	rippled
	3	0.5 m chop
	4	1.0 m chop
	5	1.5 m chop
	6	swell
Tide	code as hours from low slack on a scale of -5 (one hour after high slack) to 0 (low slack) to +6 (high slack)	
Current	1	nil
	2	weak
	3	moderate
	4	strong

Appendix Table 3. Length, weight, sex and maturity for each fish caught during the lingcod survey, Dec 1987 - Feb 1988. Data are sorted by species, sex and length. Maturity codes are described in Appendix Table 4. A fish number indicates that otoliths (rockfish) or fin rays (lingcod) were collected.

DATE	SITE	DEPTH (m)	SEX	LENGTH (mm)	WEIGHT (g)	MAT	FISH NO.
Big Skate							
880203	27	52		1200			
Copper Rockfish							
880218	51	11		242	240		
880216	127	18	1	251	307	7	12797
880126	7	18	1	275	345	7	12761
871215	19	22	1	277	402	7	11413
880201	15	15	1	277	384	1	12773
871211	53	18	1	283	385	4	11412
880126	7	18	1	295	470	7	12760
880203	27	9	1	301	475	7	12774
880201	15	15	1	302	527	7	12771
880201	15	13	1	302	496	7	12768
880215	7	18	1	303	550	7	12790
880208	30	17	1	308	542	7	12780
880108	127	18	1	309	524	7	12747
880216	127	18	1	316	512	7	12796
880118	12	15	1	318	605	7	12753
871215	19	22	1	323	616	7	11415
880210	53	18	1	339	575	7	12786
880121	30	13	1	340	585	7	11757
880201	15	13	1	350	725	7	12769
880218	51	18	1	350	700	7	12798
880201	15	31	1	352	741	7	12762
880215	3	11	1	358	925	7	12792
880108	127	18	1	370	841	7	12749
880108	51	16	1	374	876	7	12744
880108	51	37	1	388	1049	4	12743
880108	51	16	1	456	1886	7	12751
880121	127	18	1	457	1665	7	12756
880210	53	18	2	236	175	2	12788
880208	15	13	2	243	378	3	12781
880208	30	17	2	258	280	4	12779
880302	27	9	2	270	350	2	12778
880108	127	18	2	288	501	3	12750
880201	19	37	2	289	449	2	12764

Appendix table 3 (cont'd)

DATE	SITE	DEPTH (m)	SEX	LENGTH (mm)	WEIGHT (g)	MAT	FISH NO.
Copper Rockfish (cont'd)							
880216	127	18	2	290	475	3	12795
880201	19	24	2	296	460	1	12765
880216	27	15	2	301	518	3	12793
880118	12	15	2	302	540	3	12752
880201	15	15	2	302	518	3	12772
880302	27	9	2	306	500	3	12777
880210	53	18	2	312	600	3	12789
880218	51	18	2	312	505	2	12799
871215	15	15	2	316	648	2	11416
880208	15	13	2	316	658	4	12782
871215	15	15	2	321	673	3	11417
880201	15	15	2	325	698	3	12770
880216	27	15	2	326	715	3	12794
880208	30	13	2	329	627	3	12784
871215	19	22	2	330	613	2	11414
880126	3	12	2	332	705	3	12759
880208	30	13	2	335	739	3	12783
880118	12	15	2	338	650	8	12754
880208	30	13	2	340	819	4	12785
880302	27	9	2	349	750	3	12775
880118	12	15	2	353	820	2	12755
880201	19	24	2	353	702	3	12767
880108	51	16	2	366	876	2	12745
880210	53	18	2	366	925	4	12787
880126	3	17	2	368	1050	3	12758
880215	3	11	2	371	1125	3	12791
871211	53	18	2	375	860	3	11411
880201	19	24	2	376	1043	3	12766
880108	51	16	2	378	958	3	12746
880302	27	9	2	386	975	3	12776
880108	127	18	2	395	1090	3	12748
Greenstriped Rockfish							
880218	51	50	2	309	340	3	
Quillback Rockfish							
880203	13	13	1	230	225	1	11493
880118	13	49	1	247	300	1	11433
880125	12	52	1	249	286	1	11461

Appendix table 3 (cont'd)

DATE	SITE	DEPTH (m)	SEX	LENGTH (mm)	WEIGHT (g)	MAT	FISH NO.
Quillback Rockfish (cont'd)							
880118	13	49	1	250	330	1	11436
880201	15	13	1	255	328	1	11487
880201	15	31	1	263	353	1	11473
880201	15	13	1	264	365	1	11486
880201	19	24	1	273	384	7	11479
880201	15	13	1	274	436	7	11488
880121	127	18	1	275	350	1	11439
880201	19	37	1	275	352	1	11477
880108	19	22	1	280	424	7	11428
880201	15	15	1	286	456	7	11490
880126	7	18	1	288	495	7	11463
880216	12	18	1	289	424	7	11525
880216	12	18	1	292	488	7	11523
880108	19	22	1	293	562	7	11429
880216	27	29	1	297	454	7	11526
880125	7	24	1	301	450	7	11453
880126	7	18	1	301	545	7	11464
880201	15	13	1	305	541	7	11482
880203	27	22	1	309	550	7	11495
880118	13	15	1	310	515	1	11431
880201	15	15	1	310	640	7	11491
880208	15	48	1	310	674	7	11506
880108	19	33	1	311	669	7	11424
880121	127	18	1	314	535	7	11438
880216	12	27	1	328	632	7	11518
880208	15	48	1	334	800	7	11502
880118	13	49	1	336	775	7	11434
880216	12	18	1	337	717	7	11522
880125	12	18	1	338	712	7	11446
880125	12	18	1	339	680	7	11445
880208	30	29	1	342	878	7	11499
880216	12	18	1	344	734	7	11519
880201	19	37	1	345	688	7	11476
880216	12	27	1	348	748	7	11517
880218	51	55	1	349	825	7	11532
871211	53	55	1	350	750	4	12729
880125	12	48	1	350	793	7	11454
880201	15	31	1	350	817	1	11467
880108	51	48	1	352	870	4	11419
871215	15	35	1	353	952	7	12738
871215	19	35	1	355	1116	7	12740

Appendix table 3 (cont'd)

DATE	SITE	DEPTH (m)	SEX	LENGTH (mm)	WEIGHT (g)	MAT	FISH NO.
Quillback Rockfish (cont'd)							
880208	30	48	1	359	903	7	11497
880218	51	50	1	364	915	7	11535
880218	51	55	1	374	975	7	11530
871215	19	55	1	388	1042	7	12741
880201	15	31	1	388	1204	7	11471
880125	7	52	1	392	1026	7	11457
880218	51	18	1	392	925	7	11537
880201	15	31	1	395	1295	7	11466
880218	51	55	1	400	1255	7	11529
871211	53	33	1	406	1210	4	12737
880210	53	40	2	224	225	3	11510
871211	53	55	2	226	220	1	12730
880210	53	37	2	227	225	1	11508
880108	51	48	2	250	303	1	11421
880201	15	13	2	251	319	1	11485
880125	7	52	2	256	285	3	11458
880201	15	15	2	256	311	1	11489
880201	15	31	2	264	369	2	11469
880126	3	17	2	268	325	1	11462
880126	7	18	2	276	455	3	11465
880125	7	52	2	282	404	3	11459
871215	15	15	2	285	525	2	12742
880201	19	24	2	288	451	3	11480
880201	15	31	2	288	479	3	11470
871215	19	22	2	290	489	2	12739
880201	15	31	2	294	470	2	11474
880215	7	20	2	296	495		11513
880201	15	31	2	299	488	2	11475
880203	27	22	2	300	540	2	11494
880125	7	15	2	311	572	3	11450
880118	13	49	2	319	750	2	11437
880201	19	55	2	319	727	3	11481
880108	51	48	2	320	636	3	11418
880208	15	48	2	320	804	3	11505
880216	12	27	2	321	736	3	11516
880125	7	15	2	322	683	3	11448
880125	12	18	2	322	636	3	11442
880216	27	15	2	322	688	3	11527
880125	12	18	2	326	605	3	11447
880125	12	18	2	327	705	3	11443
880208	15	48	2	327	761	3	11503

Appendix table 3 (cont'd)

DATE	SITE	DEPTH (m)	SEX	LENGTH (mm)	WEIGHT (g)	MAT	FISH NO.
Quillback Rockfish (cont'd)							
880125	12	18	2	328	683	3	11444
880125	12	18	2	330	722	3	11441
880210	53	37	2	330	550	3	11507
880125	7	24	2	331	597	3	11452
880121	30	33	2	335	795	3	11440
880208	30	29	2	335	800	3	11500
880108	19	22	2	338	718	4	11430
880108	19	33	2	339	894	3	11422
880208	15	48	2	340	919	3	11504
880118	13	49	2	345	1000	2	11435
880125	7	24	2	345	758	3	11451
871211	53	31	2	346	775	2	12731
880218	51	31	2	348	820	3	11534
880216	12	18	2	354	895	3	11521
880201	15	31	2	355	951	3	11472
880216	27	15	2	355	842	3	11514
880218	51	50	2	355	805	3	11536
880201	15	13	2	356	925	3	11483
880215	3	29	2	356	781	3	11515
880216	12	18	2	357	893	3	11524
880201	15	13	2	358	962	3	11484
880118	12	37	2	359	820	2	11432
880218	51	55	2	359	875	3	11531
880302	27	9	2	360	970	3	11492
880208	30	27	2	360	998	3	11501
880108	51	48	2	361	966	3	11420
880201	15	31	2	363	1126	3	11468
880125	12	52	2	366	1142	3	11460
880216	12	18	2	366	782	3	11520
880125	12	48	2	367	865	3	11455
880210	53	37	2	368	1225	4	11509
880218	51	55	2	371	1170	3	11533
880201	19	37	2	374	1107	3	11478
871211	53	53	2	376	990	2	12734
880203	13	13	2	377	1060	3	11496
880210	53	55	2	379	1125	4	11511
871215	19	33	2	380	1149	2	12736
880108	19	33	2	386	1203	3	11426
871215	15	35	2	390	1224	2	12737
880125	7	15	2	391	1230	3	11449
880125	7	46	2	392	1221	3	11456

Appendix table 3 (cont'd)

DATE	SITE	DEPTH (m)	SEX	LENGTH (mm)	WEIGHT (g)	MAT	FISH NO.
Quillback Rockfish (cont'd)							
880108	51	48	2	393	1182	3	11425
880218	51	50	2	401	1225	3	11528
871211	53	48	2	405	1380	2	12735
871211	53	35	2	406	1365	2	12732
880208	30	48	2	415	1374	3	11498
880108	19	22	2	434	1676	3	11427
880108	19	33	2	444	1416	3	11423
Tiger Rockfish							
880218	51	31	2	381	805	3	
880201	15	13	2	420	1480	3	1
Yelloweye Rockfish							
880126	3	48	1	318	600	1	9586
880126	3	37	1	328	695	1	9587
880125	12	52	1	381	1090	7	9582
880125	12	52	1	483	2127	1	9584
880121	30	50	1	538	2625	1	9581
880126	3	37	2	239	250	1	9588
880125	7	31	2	333	623	1	9583
880126	3	48	2	640	5350	3	9585
Kelp Greenling							
880126	3	12	1	311			
880215	3	11	1	325			
880215	7	20	1	400			
880201	15	13	1	420			
880201	15	15	2	350			
880201	15	15	2	398			
880108	19	33	2	430			
Lingcod							
880215	3	11		841	6100	9	544
880126	7	18	1	484	1090	7	485
880125	7	15	1	501	1225	7	467
880126	7	18	1	520	1220	7	484
880215	7	20	1	523	1325	8	547

Appendix table 3 (cont'd)

DATE	SITE	DEPTH (m)	SEX	LENGTH (mm)	WEIGHT (g)	MAT	FISH NO.
Lingcod (cont'd)							
880126	3	17	1	524	1225	2	495
871215	15	15	1	525	1440	3	412
880215	3	29	1	534	1575	8	537
880126	3	17	1	542	1410	7	494
880215	7	20	1	545	1500	7	548
880125	7	24	1	550	1750	7	477
880118	13	15	1	553	1770	4	439
880215	7	20	1	558	1625	8	527
880218	51	11	1	560	1575	8	555
880201	15	31	1	570	2035	4	497
880215	7	20	1	572	1875	8	529
880108	51	16	1	575	1827	4	
880118	13	15	1	592	2315	7	444
880125	12	18	1	594	2150	4	456
880215	7	18	1	594	2175	8	538
880108	51	16	1	600	2282	4	
880125	7	15	1	601	2275	7	470
880208	30	13	1	606	2260	8	511
880215	3	11	1	610	2625	8	541
871215	15	35	1	618	2650	4	414
880126	7	18	1	618	2270	7	483
880125	12	48	1	620	2350	2	453
880203	27	9	1	623	2550	8	504
880126	3	17	1	627	2515	4	492
871215	19	35	1	630	2485	3	423
880125	7	15	1	633	2725	7	464
880216	12	18	1	645	2490	8	551
880118	13	15	1	651	2825	4	442
880125	7	15	1	655	2850	4	472
880126	3	17	1	660	3015	7	490
880216	27	15	1	679	3535	8	553
880216	27	15	1	691	3550	8	554
880121	30	15	1	705	3560	7	449
871215	19	35	1	710	4090	4	422
880208	30	13	1	713	3560	8	509
880216	12	18	1	718	3780	8	552
880126	3	48	1	780	4550	7	488
871215	19	33	2		2725	2	425
880210	53	17	2	488	1150	2	523
880210	53	37	2	490	1020	2	526

Appendix table 3 (cont'd)

DATE	SITE	DEPTH (m)	SEX	LENGTH (mm)	WEIGHT (g)	MAT	FISH NO.
Lingcod (cont'd)							
880215	7	20	2	534	1495	2	549
880125	12	18	2	540	1600	2	458
880125	7	31	2	552	1550	2	480
871211	53	31	2	560	1880	6	
880215	3	11	2	574	1775	2	539
871211	53	35	2	581	1965	6	
880218	51	50	2	584	2000	9	556
880210	53	37	2	585	1745	8	524
880126	3	17	2	587	1925	2	493
880208	30	17	2	588	1880	8	517
880121	30	15	2	595	2105	2	450
880215	3	11	2	598	1975	9	543
880121	127	18	2	602	2050	2	446
880201	15	15	2	615	2190	9	499
880215	7	20	2	615	2300	2	533
880215	7	20	2	624	2600	2	534
880125	7	15	2	625	2650	2	466
880125	7	24	2	625	2725	7	474
880118	13	15	2	630	2495	2	440
880125	7	46	2	635	2725	6	460
871215	19	53	2	641	2630	2	409
871211	53	31	2	643	2750	5	
871215	19	53	2	646	2650	2	407
880121	127	18	2	646	2540	2	445
880118	13	11	2	648	2760	2	435
880121	127	18	2	648	2790	7	447
880210	53	37	2	651	2580	8	525
880215	7	18	2	654	2700	8	550
880118	13	31	2	657	2605	2	443
880125	7	15	2	657	3150	7	471
880125	12	18	2	658	2700	2	459
880201	15	13	2	658	2950	2	500
880208	30	17	2	659	2830	2	521
871215	15	35	2	663	3450	5	413
880125	7	46	2	663	2475	2	461
880215	7	20	2	663	3150	8	536
880125	12	18	2	667	3175	2	457
880118	13	11	2	674	3525	6	436
880125	12	52	2	674	3350	6	454
880126	7	18	2	674	3290	2	482
880126	3	13	2	680	3650	7	486

Appendix table 3 (cont'd)

DATE	SITE	DEPTH (m)	SEX	LENGTH (mm)	WEIGHT (g)	MAT	FISH NO.
Lingcod (cont'd)							
871211	53	35	2	682	3145	6	
880215	7	20	2	687	3850	8	535
880118	13	11	2	690	3645	7	429
871215	19	53	2	691	3860	6	408
871215	15	15	2	691	3840	6	411
880203	27	29	2	691	3695	8	505
880126	7	18	2	693	3650	7	481
880215	3	11	2	699	3050	9	546
880118	13	11	2	708	4270	7	430
880210	53	55	2	713	3280	8	522
880215	7	20	2	714	3350	8	532
880125	12	18	2	718	4150	2	455
880125	7	15	2	720	4825	7	465
880201	19	37	2	720	4085	9	502
880215	7	20	2	720	3575	8	528
880118	13	11	2	721	4610	6	433
880125	7	15	2	722	3575	8	473
880125	7	15	2	724	3700	8	468
880126	3	17	2	724	4685	7	491
880215	7	20	2	725	4950	8	531
880118	13	15	2	727	4980	6	441
880208	30	29	2	732	4385	8	514
880125	7	24	2	738	3800	8	475
880121	30	15	2	743	4375	7	448
880125	7	15	2	749	4075	8	469
871215	19	55	2	750	4810	5	406
880118	13	11	2	755	3965	8	431
880208	30	17	2	756	4250	8	518
880208	30	13	2	756	4850	8	510
871215	19	35	2	758	6010	6	420
880125	12	48	2	760	4600	6	452
880208	30	29	2	760	4190	8	512
880215	3	11	2	761	4625	8	540
880125	12	18	2	764	5200	7	478
880201	15	31	2	767	5855	7	496
871215	15	35	2	772	4985	6	418
871215	19	35	2	773	5700	5	419
880201	19	24	2	775	5900	7	503
871215	19	35	2	778	5875	5	421
880201	19	37	2	778	4675	8	501
880125	7	15	2	781	4625	8	479

Appendix table 3 (cont'd)

DATE	SITE	DEPTH (m)	SEX	LENGTH (mm)	WEIGHT (g)	MAT	FISH NO.
Lingcod (cont'd)							
880126	3	31	2	782	3940	7	489
880208	30	27	2	782	4550	8	508
880208	30	29	2	784	4475	8	516
871215	19	22	2	785	5290	5	424
871215	19	55	2	785	5250	5	405
880208	30	29	2	789	4715	8	515
880215	3	11	2	795	4925	8	542
871215	15	15	2	796	5870	6	410
880201	15	15	2	802	5305	8	498
880108	19	22	2	805	6685	7	
871215	15	35	2	815	6370	5	417
880203	27	22	2	820	5030	8	507
880125	7	46	2	825	5925	8	462
880118	13	11	2	839	6910	7	432
880208	30	17	2	841	5370	8	520
880125	7	46	2	854	7475	7	463
880118	13	15	2	862	6595	2	437
880215	3	11	2	870	6495	8	545
880118	13	11	2	878	7970	7	434
880125	7	24	2	881	6575	8	476
880121	30	13	2	884	9425	7	451
880203	27	29	2	894	9050	8	506
880215	7	20	2	895	6050	8	530
880118	13	15	2	898	9275	7	438
880208	30	29	2	910	7640	8	513
880208	30	17	2	920	7885	8	519
871215	15	35	2	923	9780	6	415
871215	15	35	2	928	8900	6	416
880126	3	13	2	965	13675	7	487
Red Irish Lord							
880201	15	31		365			
Cabezon							
871215	19	9					
880121	127	18		515			
871215	19	55		550			
871215	15	15		575			
880201	15	31		600			

Appendix table 3 (cont'd)

DATE	SITE	DEPTH (m)	SEX	LENGTH (mm)	WEIGHT (g)	MAT	FISH NO.
Rock Sole							
871215	15	15		315	383		
880210	53	40		351			
English Sole							
880118	13	49		140			
880118	13	49		290			

Appendix table 4a. Codes used to describe rockfish maturity stages, modified from Hand and Richards (1987).

Maturity code		Gonad condition
	0	Unknown
	1	Immature (translucent: males threadlike; females small)
Females	2	Maturing (small, yellow eggs; translucent or opaque)
	3	Mature (large cream, yellow or orange eggs; opaque)
	4	Fertilized (large yellow-orange eggs; translucent)
	5	Embryos or larvae (include eyed eggs; translucent)
	6	Spent (large, flaccid, red ovaries: a few larvae may be present)
	7	Resting (moderate size, firm, orange-grey ovaries: some with dark blotches)
Males	2	Maturing (stringlike, slight swelling, translucent pink)
	3	Developing (swelling, brown-white)
	4	Developed (large, white; easily broken)
	5	Running (running milt)
	6	Spent (flaccid, red)
	7	Resting (ribbon-like; small, brown)

Appendix table 4b. Codes used to describe lingcod maturity stages, modified from Cass et al. (1984).

Maturity code		Gonad condition
	0	unknown
	1	immature; (males stringlike; females small)
	2	immature; (males flat, transparent and slightly enlarged; females, slightly enlarged)
females	3	ova are semi-transparent and less than 1 mm in diameter, ovaries fill one-third of the body cavity
	4	ova are opaque and about 1 mm in diameter, ovaries fill two-thirds of the body cavity
	5	ova are less than 2 mm in diameter, ovaries fill 80% of body cavity
	6	ova are about 2 mm in diameter
	7	ripe (ova are larger than 2 mm in diameter, ovaries visibly fill and distend body cavity)
	8	spent (ovary may be bloodshot and purple in colour, ovary is flaccid and about one-third to two-thirds of the body cavity)
	9	resorbing (ova are large to opaque and degenerating)
	10	recovering (ovaries returning to pre-ripening stage (code 3) ovaries are firm and fill less than half the body cavity, new ova are small)
	11	resting (ovaries fill less than one-third of the body cavity, no ova present)
males	3	testes enlarged, filling less than one-quarter of the body cavity and white to brown in colour
	4	testes enlarged to two-thirds of the body cavity, cross-sections of the gonad will produce milt
	7	ripe (testes are large and full of milt)
	8	spent (testes are flaccid, reduced in size and may contain some milt)
	11	resting (testes are less than one-third of the body cavity, usually brown in colour and devoid of milt)